

TROPICAL STORM RUBY (14W)

Ruby was the last of three disturbances to develop in the active southwest monsoon trough near 20N latitude during late August. Unlike its predecessors, Typhoons Odessa and Pat, Ruby did not engage in any complex binary interaction, but appeared to remain a solitary system. Ruby was noteworthy in that it tracked directly over the Tokyo metropolitan area.

On 24 August the well-developed monsoon trough was displaced north of its climatological position and provided large scale low-level converging flow. This flow was the combination of the southwest monsoon and the southeast trades around the southwest periphery of the strong subtropical ridge located east of Japan. The low-level monsoon trough had a narrow, but active, tropical upper-tropospheric trough (TUTT) located aloft and to the north, and the upper-level near-equatorial ridge to the south.

Synoptic data on the 25th of August revealed a small (60 nm (111 km) diameter) circulation with a minimum sea level pressure (MSLP) of 1006 mb 330 nm (611 km) south-southeast of the island of Okinawa. Initial mention of this area appeared on the 250600Z Significant Tropical Weather Advisory (ABPW PGTW). The disturbance weakened a day later. Post-analysis showed the circulation tracked eastward and the convection associated with the disturbance exhibited typical monsoon depression characteristics - some curvature, but the enhanced convection only on the equatorward side of the trough. Increased surface winds of 25 kt (13 m/s) on the eastern side of the

circulation and a steady drop of sea-level pressure to 1002 mb, prompted new mention of the disturbance on the Significant Tropical Weather Advisory (ABPW PGTW) at 270600Z. A Tropical Cyclone Formation Alert (TCFA) followed at 271800Z based on a 25 kt (13 m/s) satellite intensity estimate based on convection that had consolidated into a ragged central dense overcast (CDO) feature. Aircraft reconnaissance was subsequently scheduled for the daylight hours of the 28th of August. At that time the typhoon forecaster was faced with a dilemma: was the flare-up of convection at the end of the monsoon trough just another clash of the low-level southeasterlies, or was the signature that of a maturing tropical cyclone? Ruby's relatively close proximity to Typhoon Odessa (to the northwest) and the apparent weak surface inflow in the northwest quadrant, as depicted by the sparse synoptic data, deepened the uncertainty concerning the intensity of the system.

The question was answered when the initial aircraft reconnaissance mission at 280020Z reported an elliptical eye forming and a minimum sea-level pressure of 982 mb. Based on this information, the first warning on Tropical Storm Ruby was issued immediately. Satellite imagery showed the cloudiness was comma shaped with a large band of convection coming into the center from the southeast. This convective band was positioned over the strong zone of convergence between the monsoon and the southeast trades. The data sparse analysis at 280000Z, shown in Figure 3-14-1, depicts this convergent area. Additionally, aircraft reconnaissance reported that

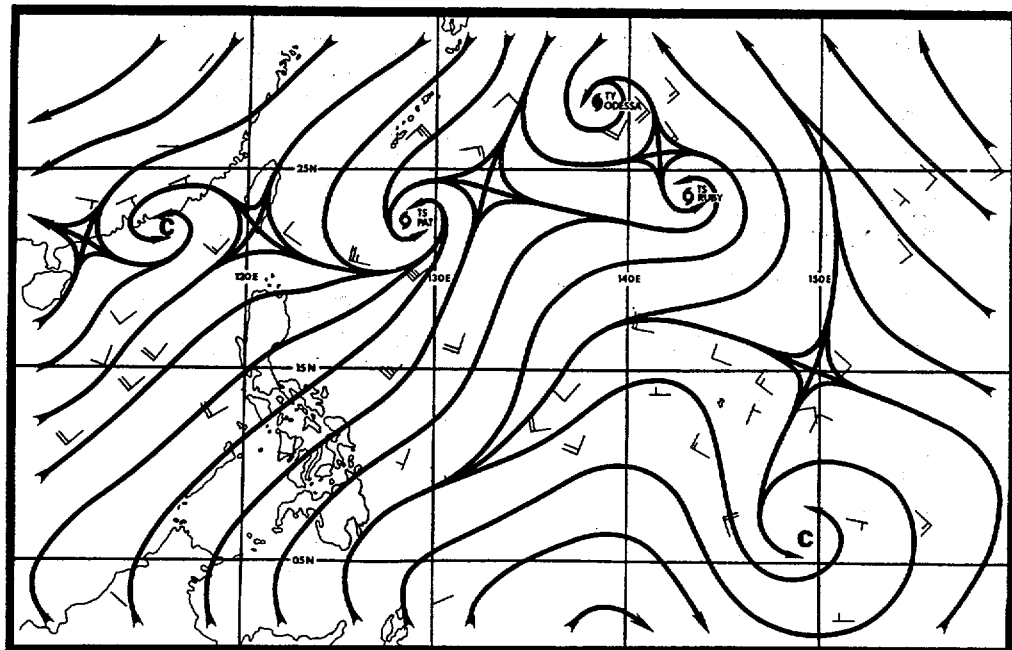


Figure 3-14-1. Surface/gradient analysis at 280000Z showing Tropical Storm Ruby located at the eastern end of the southwest monsoon flow where it converges with the southeast trades.

maximum sustained winds of 50 kt (26 m/s) with gusts to 65 kt (33 m/s) were restricted to the area of the low-level convergence and cloud band. Elsewhere, to the west and southwest, the aircraft found only 15-30 kt (8-15 m/s) surface winds. Figure 3-14-2 shows the proximity of Odessa to Ruby. The continuous vertical shear from the outflow of Odessa to the northwest appears to have hampered Ruby's further development.

During the following twenty-four hours, Ruby turned northwestward and gradually increased speed. Finally, late on the 29th, Ruby appeared to be breaking free of the monsoon trough. The forecast philosophy throughout the 28th and 29th of August was for Ruby, like Odessa, to turn more westward, stay equa-

torward of the narrow subtropical ridge and pass south of Honshu, Japan. This forecast scenario was based on Ruby's interaction with Typhoon Pat. Ruby was forecast to be pulled around the northern periphery of Pat's much larger circulation, which was centered southeast of Okinawa, Japan. Initially, the synoptic situation and, as a result, the meteorological reasoning appeared to be similar to that for Odessa and contrary to guidance provided by the best forecast aid, the One-way Tropical Cyclone Model (OTCM). OTCM moved Ruby northward into the subtropical ridge and towards Honshu, Japan, but at a slower speed than it had previously with Odessa. OTCM apparently was responding to the approach of a mid-latitude short wave trough. Figure 3-14-3 compares



Figure 3-14-2. Nighttime moonlight satellite imagery of Ruby. The close proximity of Odessa to Ruby appears to have hampered Ruby's further development. Ruby is near maximum intensity of 55 kt (28 m/s) (281248Z August DMSP visual imagery).

OTCM guidance with the forecasts for warnings 04 through 08. By following the forecast philosophy that OTCM still could not resolve the narrow subtropical ridge (due to its larger internal grid spacing), the warnings failed to reflect Ruby's gradual recurvature and subsequent landfall until approximately six hours before the event.

Over a thirty-six hour period, between 281200Z and 300000Z, the Tropical Storm maintained a maximum intensity of 55 kt (28 m/s). Ruby packed 55 kt (28 m/s) winds as it moved south of Tokyo, Japan, but began to weaken just prior to moving into Tokyo Bay

and the Kanto Plain. Satellite imagery showed Ruby lost most of its central convection before making landfall due to interaction with the mid-latitude westerlies. Yokosuka received maximum sustained winds of 33 kt (17 m/s) with gusts to 47 kt (24 m/s) at 301420Z, as Ruby passed 5-10 nm (9-19 km) to the east. During this period Tokyo received three inches (76 mm) of rain and minor damage - trees down, windows broken and power outages for thousands of homes. After twelve hours over land, Ruby moved back into the Pacific and completed extratropical transition at 311000Z.

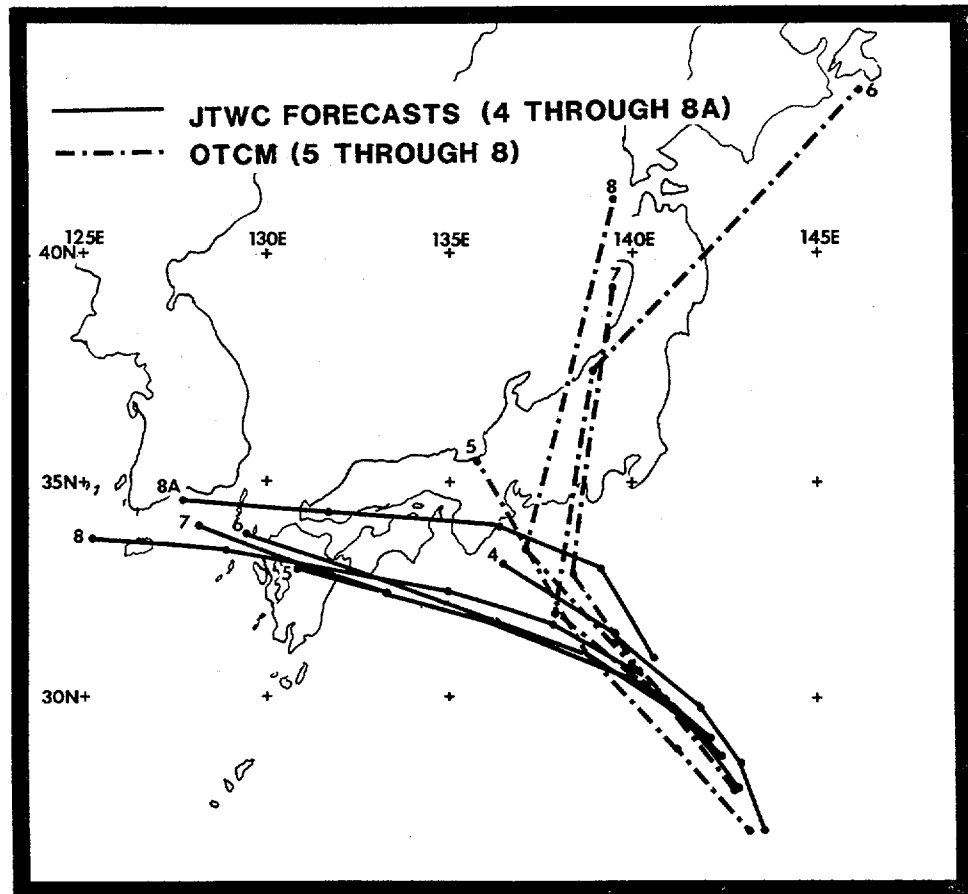


Figure 3-14-3. A comparison of OTCM guidance and the forecasts for five warnings (04 through 08).